predetermined ratio and increasing the concentration of one of said oxygen-containing gas or said hydrogen containing gas after a reaction begins. --

REMARKS

This application has been carefully reviewed in light of the Office Action dated October 15, 1999. Applicant has amended claims 1, 9 and 16, canceled claims 3, 4, 10, 11, 17 and 18, and added claims 20-28. Reconsideration and favorable action in this case are respectfully requested.

Applicant has amended the specification to correct grammatical errors.

The Examiner has rejected claims 1 – 8 under 35 U.S.C. §103(a) as being unpatentable over U.S. Pat. No. 5,352,620 to Komori et al (hereinafter "Komori") in view of U.S. Pat. No 4,505,028 to Kobayashi et al (hereinafter "Kobayashi") and two references to Wolf (collectively the "Wolf references"). Claims 9-11 and 13-15 stand rejected under 35 U.S.C. §102(b) as being anticipated by Kobayashi. The Examiner has further rejected claim 12 under §103(a) as being unpatentable over Kobayashi and has rejected claims 16 – 18 under 35 U.S.C. §103(a) as being unpatentable over Komori. Applicant has reviewed these references in detail and does not believe that they discloses or makes obvious the invention as claimed by the amended claims.

In the Office Action, the Examiner states that Komori teaches a method of fabricating an electrical device in a semiconductor substrate by forming an insulating layer over the semiconductor substrate, forming a silicon containing structure on the insulating layer and forming a conductive structure on the silicon containing structure. The Examiner further states that Komori teaches oxidizing a

portion of the insulating layer and the silicon containing structure by a process that comprises the selective oxidation of silicon and leaving the conductive structure substantially unoxidized.

The Examiner specifically notes that Komori does not show the oxygen-containing gas and the hydrogen-containing gas, but contends that Kobayashi teaches a method of oxidizing that comprises H_2O used as the oxygen-containing gas and H_2 as the hydrogen-containing gas. The Examiner further notes the Wolf teaches an oxidation process where the oxygen-containing gas by be either H_2O or O_2.

Independent claim 1 has been amended. In its revised form, claim 1 includes the step of oxidizing a portion of said insulating layer and the silicon-containing structure while leaving the conductive structure substantially unoxidized by introducing O_2 and H_2 to the insulating layer, the silicon-containing structure and the conductive structure.

None of the references cited by the Examiner teach the use of O_2 and H_2 for selective oxidation. As stated by the Examiner, Komori does not teach the use of an oxygen-containing gas and a hydrogen-containing gas. Wolf teaches the use of O_2 for oxidation, but not in conjunction with H_2 or any other hydrogen-containing gas. Without the addition of the hydrogen containing gas, *significant oxidation of the conductive structure would result.* Kobayashi shows the use of H_2O and H_2 for oxidation purposes. This technique, however, is inferior to the method described in claim 1. As described in the present specification (page 2, lines 5 through 12), a problem with using H_2O is that only small quantities of water can be used and it is extremely difficult to controllably introduce such small

amounts of water in large scale production of semiconductor devices. As a result, devices made using H_2O as an oxidant may vary significantly between runs.

It simply is not the case that different oxidizing gases can be substituted in a process. For example, as described in the specification, the combination of O_2 and H_2 can result in high pressures, even explosive pressures. However, when used in conditions which result in safe pressures, the combination provides a process which prevents oxidations of the conductive structure, while remaining controllable, i.e., consistent from run to run.

Accordingly, the invention defined by claim 1 is not shown in the prior art references cited by the Examiner, and provides significant benefits over the methods shown in the prior art.

Claim 9 describes a method of oxidizing a first feature while leaving a second feature substantially unoxidized, where first and second features are subjected to O_2 and H_2. Again, as described in connection with claim 1, no reference cited by the Examiner shows the use of O_2 and H_2 together, and it would not be obvious to use O_2 in combination with H_2, because of the potentially explosive nature of the combination.

Claim 16 describes a method of fabricating a capacitor having a dielectric between a bottom electrode and a top electrode and situated over a semiconductor substrate by providing the bottom electrode over the semiconductor substrate, providing a dielectric material over the bottom electrode, and subjecting the bottom electrode and the dielectric material to O_2 and H_2, wherein the dielectric material is oxidized and the bottom electrode remains substantially unoxidized.

Once again, as described in connection with claims 1 and 9, no reference cited by the Examiner shows the use of O_2 and H_2 together, and it would not be obvious to use O_2 in combination with H_2, because of the potentially explosive nature of the combination.

Claim 20, which is dependent upon claim 1, specifies that the oxidizing step comprises the step of oxidizing a portion of the insulating layer and the silicon-containing structure while leaving the conductive structure substantially unoxidized by introducing O_2 and H_2 in a portion of a process chamber's total volume. This aspect of the invention, as described in connection with page 7, lines 6-12, improves the safety of the process and allows the process window to be enlarged, because the reaction occurs in only a portion of the total volume of the process chamber, thereby leaving the rest of the volume available for expansion. Similarly, claims 22 (dependent upon claim 9) and 24 (dependent upon claim 16) provide the step of introducing O_2 and H_2 in a portion of a process chamber's total volume. This aspect of the invention is not taught by any of the references cited by the Examiner.

Claim 21, which is also dependent upon claim 1, specifies that the O2 and H2 are introduced at a predetermined ration and the concentration of one of the O_2 or H_2 is increased after a reaction begins. Similarly, claims 23 and 25 provide the step of introducing O_2 and H_2 in a predetermined ratio and increasing the concentration of one of said O_2 or H_2 after a reaction begins. This aspect of the invention also increases the safety of the process and is not taught in any of the references cited by the Examiner.

Claim 26 is a new independent claim describing a method of fabricating an electrical device formed in a semiconductor substrate by forming an insulating layer over said semiconductor substrate, forming a silicon-containing structure on said insulating layer, forming a conductive structure on said silicon-containing structure, and oxidizing a portion of said insulating layer and said silicon-containing structure while leaving said conductive structure substantially unoxidized by introducing an oxygen-containing gas selected from the group consisting of O_2, N_2O, CO_2 and a separate hydrogen-containing gas to said insulating layer, said silicon-containing structure and said conductive structure.

As described above, the Kobayashi reference only describes the use of H_2 as a reducing gas in conjunction with H_2O. Using H_2 in conjunction with O_2, N_2O, CO_2 is not shown by the references.

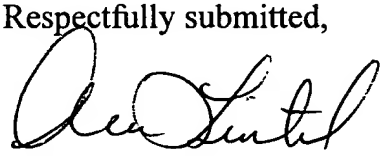
Applicant has now made an earnest attempt to place this case in condition for allowance. For the foregoing reasons and for other reasons clearly apparent, Applicant respectfully requests full allowance of Claims 1-28.

An extension of three months is requested and a Petition for Extension of Time under § 1.136 with the appropriate fee payable by deposit account is attached hereto.

With the addition of claims 20-28, including one new independent claim and eight new dependent claims (less six of the original dependent claims), a payment of $114.00 is due. The Commissioner is authorized to charge this fee to Deposit Account No. 20-0668 of Texas Instruments Incorporated.

The Commissioner is hereby authorized to charge any fees or credit any overpayment, including extension fees and fees for additional claims, to Deposit Account No. 20-0668 of Texas Instruments Incorporated.

Respectfully submitted,



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